JACC Vol. 16, No. 3
September 1990:607–10

Incidence and Prognostic Significance of Intraventricular Conduction Abnormalities After Coronary Bypass Surgery

E. MURAT TUZCU, MD, ATILA EMRE, MD, MARLENE GOORMASTIC, MPH, FLOYD D. LOOP, MD, FACC, DONALD A. UNDERWOOD, MD, FACC

To determine the incidence and prognostic significance of new postoperative conduction disturbances, 2,000 consecutive patients who underwent primary elective coronary bypass surgery were evaluated. One hundred eleven (5.5%) of the 2,000 patients developed a new intraventricular conduction defect that persisted to hospital discharge. Right bundle branch block occurred in 86 (85%), left bundle branch block in 5 (4%) and nonspecific intraventricular conduction defect in 9 (11%).

One hundred of these 111 patients were successfully matched with others in the study population who had maintained normal intraventricular conduction during the operative period. Patients were matched on the basis of age, gender, absence of preoperative conduction disturbances, left ventricular function and bypass grafts to the same vessels. Follow-up of the two groups for a period of 1 to 76 months (mean 60 months) failed to show any difference in survival or cardiac events such as myocardial infarction, repeat coronary bypass surgery, coronary angioplasty and permanent pacemaker implantation.

The appearance of right or left bundle branch block or a nonspecific intraventricular conduction defect after coronary bypass surgery does not appear to have an unfavorable impact on the long-term prognosis of these patients.

(J Am Coll Cardiol 1990;16:607–10)

The incidence of new conduction disturbances after coronary artery bypass surgery has been reported to be between 1% and 45% (1–7). Most studies (1,3,6,7) have dealt with their incidence and mechanism. Little is known about their prognostic significance and few investigators have addressed the long-term outcome of patients who develop a new fascicular conduction disturbance after coronary bypass surgery.

In this study we analyzed the incidence and prognostic significance of new postoperative left or right bundle branch block and nonspecific intraventricular conduction defect in 2,000 consecutive patients who underwent elective coronary bypass surgery.

Methods

Study patients. We evaluated the first consecutive 1,000 patients who underwent primary elective coronary artery bypass surgery at the Cleveland Clinic Foundation during the years 1983 and 1984. Patients who underwent a concomitant valve operation, aneurysm resection, carotid endarterectomy, reoperation or emergency surgery were excluded. The 12 lead electrocardiograms (ECG) selected for review were tracings recorded before surgery and on the 1st and 6th day after surgery. Electrocardiograms of the 2,000 patients were reviewed by three cardiologists independently.

Of the 2,000 patients, 111 had new right bundle branch block (QRS complex duration >120 ms with a broad R^1 deflection in precordial lead V_1 and a broad S wave in precordial leads V_5 or V_6) or left bundle branch block (QRS duration >120 ms with absent Q waves in lead I and precordial lead V_6 and with secondary ST-T wave changes) or nonspecific interventricular conduction defect (QRS duration >120 ms with nonspecific depolarization patterns) on the 1st as well as on the 6th postoperative day. These 111 patients were matched with others from the same series of 2,000 patients on the basis of absence of preoperative conduction disturbances, age, gender, left ventricular function, number of bypass grafts and vessels grafted. Satisfactory matched control patients were obtained for 100 of the 111 patients.

Data collection. Information was obtained from the computerized data base of the Cardiovascular Information Registry. The following preoperative variables were collected:

From the Departments of Cardiology, Biostatistics, Cardiovascular and Thoracic Surgery, and Epidemiology, Cleveland Clinic Foundation, Cleveland, Ohio.

Manuscript received November 17, 1989; revised manuscript received March 14, 1990, accepted April 11, 1990.

Address for reprints: Donald A. Underwood, MD, Department of Cardiology, Cleveland Clinic Foundation, One Clinic Center, 9500 Euclid Avenue, Cleveland, Ohio 44195.

0735-1097/90/$3.50

age, gender, history of hypertension, hyperlipidemia, diabetes, family history of coronary artery disease, cigarette use, prior myocardial infarction, New York Heart Association functional classification of angina pectoris, occurrence of ventricular tachycardia or ventricular fibrillation and preoperative cardiac medications. Single, double and triple vessel disease were defined as ≥50% diameter stenosis in one, two or three major epicardial arteries or their branches, respectively. Left ventricular function was assessed visually on angiography and described as normal, mild, moderate or severely impaired.

The following operative variables were assessed: number of grafts, complete revascularization and perioperative myocardial infarction (defined as the appearance of new Q waves). Operative mortality was defined as death that occurred intraoperatively or during the same hospitalization.

Follow-up. Follow-up information, obtained by trained personnel through telephone calls, included survival status, cause of death if the patient had died, symptomatic status and interval events: myocardial infarction, coronary bypass surgery, ventricular tachycardia, ventricular fibrillation, syncope and pacemaker implantation. Referring physicians were contacted whenever necessary.

Two patients were lost to follow-up. The matches for these were also excluded from survival analysis. The mean length of follow-up was 60 months (range 1 to 75) for the conduction abnormality group and 61 months (range 1 to 76) for the control group. All but two patients who survived had at least 60 months' follow-up. Because of the matching design of this study, the actual comparison of survival for the two groups was done with the Cox proportional hazards model.

Results

Clinical features. One hundred matched patients with a new intraventricular conduction defect made up the study group. There were 86 with right bundle branch block, 9 with a nonspecific intraventricular conduction defect and 5 with left bundle branch block. Eighty-one of the 100 patients were men; the mean age of the entire group was 63 years. Of the 11 patients who were excluded from the analysis because of inability to find a matched control, 8 had right bundle branch block and 3 had nonspecific intraventricular conduction defect.

Preoperative clinical and angiographic characteristics were similar in the two groups (Tables 1 and 2). Preoperative use of digitalis, diuretics, antiarrhythmic drugs and beta-adrenergic blocking drugs was similar for the study and control groups. Use of calcium channel blocking drugs was more frequent among those who develop a conduction defect (McNemar's test) than among those who did not.

In addition to these 111 patients with a fixed conduction defect, 69 other patients had a transient defect that disappeared by day 6 (right bundle branch block in 58, left bundle branch block in 6 and intraventricular conduction defect in 5) (Table 3).

Table 1. Preoperative Clinical Characteristics of Patients in the Matched Study Group and Control Group*

	Conduction Disturbance Group (n = 100)	Control Group (n = 100)
Systemic hypertension	20	21
Diabetes mellitus	12	12
Family history for coronary artery disease	53	59
Cigarette smoking	36	37
Previous myocardial infarction	58	53
Angina pectoris		
None	34	28
Class I	2	2
Class II	53	59
Class III	5	8
Class IV	6	3
Mean cholesterol level (mg/dl)	239	252

*No differences between the two groups were statistically significant. Class I to IV = New York Heart Association functional class.

Clinical course. In the conduction abnormality and the control groups, the average number of grafts was 3.7 grafts per patient. A perioperative myocardial infarction was diagnosed in two patients in the conduction abnormality group and in one patient in the control group ($p = 0.5$). There were three in-hospital deaths, two in the conduction abnormality group and one in the control group ($p = 0.5$).

Follow-up. The survival rate at 5 years was 86% for the conduction abnormality group and 87% for the control group. Of the 14 deaths in the former group, 9 were noncardiac. Of the five cardiac deaths, three were in patients with right bundle branch block and two in patients with a nonspecific intraventricular conduction defect; therefore, the cardiac survival rate at 5 years in the patients with a

Table 2. Angiographic Findings Among Patients in the Matched Study Group and Control Group

	Conduction Disturbance Group (n = 100)	Control Group (n = 100)
Extent of disease		
Single vessel	3	3
Double vessel	27	27
Triple vessel	70	70
Left ventricular function		
Normal	40	41
Mild dysfunction	29	28
Moderate dysfunction	18	18
Severe dysfunction	13	13

Table 3. Transient and Persistent Conduction Disturbances After Coronary Bypass Surgery in 2,000 Patients

	Total		Transient		Permanent	
	No.	(%)	No.	(%)	No.	(%)
Right bundle branch block	152	(85)	58	(84)	94	(85)
Left bundle branch block	11	(6)	6	(9)	5	(4)
Intraventricular conduction defect	17	(9)	5	(7)	12	(11)

conduction defect was 95%. There were 16 deaths in the control group, 8 of which were noncardiac (cardiac survival rate at 5 years, 93%).

The 5 year cardiac survival rate of 14 patients who developed persistent left bundle branch block or intraventricular conduction defect was 86%, the same as that of the 14 matched control patients. The cardiac survival rate of the 84 patients with right bundle branch block and the 84 matched control patients was 96% and 94%, respectively (p = NS).

The cardiac events in the study and control groups are listed in Table 4. The rate of freedom from cardiac events at 5 years was 83% for the study group and 79% for the control group (p = 0.71). The rate of freedom from cardiac events or death in patients with left bundle branch block or intraventricular conduction defect and in their matched control subjects was 86% and 64%, respectively (p = 0.25). Freedom from cardiac events in patients with right bundle branch block and their matched control groups was 82% and 81%, respectively (p = NS).

Interval myocardial infarction developed in 5 patients with a conduction abnormality and in 10 control subjects. Six patients in the conduction abnormality group and three control subjects required permanent pacemaker implantation. Repeat coronary artery bypass surgery was required in three patients in the study group and two in the control group. No patient in the study group required coronary angioplasty although it was required by four patients in the control group (Table 4). These differences in the two groups were not significant.

Discussion

New postoperative bundle branch block or nonspecific intraventricular conduction defects were seen in 9% of our patients early after coronary bypass surgery. The prevalence dropped to 5.5% in the ECG recorded before hospital discharge. In their 1973 report Satinsky et al. (1) found no left bundle branch block and only one transient right bundle branch block in 116 patients who underwent coronary bypass surgery. During the last decade several investigators (4,6,7) have reported an incidence rate of fascicular conduction disturbances of 17% to 45% for the early postoperative period and of 7% to 29% at a later postoperative date. These variations are partly the result of differences in the definition of conduction disturbances and the timing of recording of the ECG.

Right versus left bundle branch block. Right bundle branch block constituted 84% of the transient and 85% of the persistent conduction disturbances in our patients. The incidence rate of new left bundle branch block was <1% in our 2,000 patients compared with previously reported rates ranging from 3% to 10% in the early hospital stay and from 1.5% to 19% in the late hospital stay after bypass surgery (2,4). Some investigators have reported that left bundle branch block and intraventricular conduction defect are more likely to be permanent than is right bundle branch block (4). In our study left bundle branch block and intraventricular conduction defect were permanent in 60% and right bundle branch block was permanent in 62% of the patients.

Previous studies. Zeldis et al. (2) followed up 200 consecutive patients for 13 to 39 months after bypass surgery. Of these 200 patients, 39 had a new conduction disturbance. The investigators found significantly higher mortality and morbidity rates in patients with new left bundle branch block and left anterior hemiblock compared with patients with no conduction disturbance. The small number of patients in their study, the relatively short follow-up time and the differences in the preoperative and intraoperative characteristics of patients in the two groups limited the conclusions of their study. Bateman et al. (4) also found a different prog-

Table 4. Cardiac Events During 5 Year Follow-Up of Patients in the Matched Study Group and Control Group

	Right Bundle Branch Block (n = 86)	Left Bundle Branch Block (n = 5)	Intraventricular Conduction Defect (n = 9)	All Conduction Defects (n = 100)	Control (n = 100)
Myocardial infarction	5	0	0	5	10
Second bypass surgery	3	0	0	3	2
Coronary angioplasty	0	0	0	0	4
Pacemaker implantation	6	0	0	6	3
Death	11	1	2	14	16

nosis in patients with new left bundle branch block or intraventricular conduction defect compared with those with no conduction disturbance. At a mean follow-up period of 66 months there were no cardiac deaths in the normal conduction group in contrast with a 38% late mortality rate in the group with left bundle branch block or intraventricular conduction defect. In their study, however, the patients with new left bundle branch block and intraventricular conduction defect had significantly more grafts placed and a higher incidence of perioperative myocardial infarction compared with the control group. Wexelman et al. (5) followed up 200 consecutive patients for 14 months after bypass surgery and found no significant difference in the long-term survival and event-free survival rates of patients with and without different types of conduction disturbances.

Conclusions. In our study, patients with conduction disturbances had control patients matched one to one for the prognostic determinants of age, gender and left ventricular function as well as artery grafted and number of grafts per patient; this should improve the comparable nature of the control group. The perioperative myocardial infarction rate was low, reflecting the definition in our registry based on new significant Q waves; it was similar in patients with and without postoperative conduction abnormality.

New postoperative left bundle branch block, right bundle branch block and intraventricular conduction defects occur postoperatively <10% of the time and persist to hospital discharge in 5.5% of patients. The majority of these conduction disturbances consist of right bundle branch block. The presence of any of these conduction disturbances does not appear to have an impact on the survival or cardiovascular events of patients during follow-up. The presence of these conduction disturbances also does not increase the need for pacemaker placement.

We appreciate the secretarial assistance of Paula LaManna.

References

1. Satinsky JD, Collins JJ Jr, Dalen JE. Conduction defects after cardiac surgery. Circulation 1974;50(suppl II):II-170–4.
2. Zeldis SM, Morganroth J, Horowitz LN, et al. Fascicular conduction disturbances after coronary bypass surgery. Am J Cardiol 1978;41:860–4.
3. O'Connell JB, Wallis D, Johnson SA, Pifarre R, Gunnar RM. Transient bundle branch block following use of hypothermic cardioplegia in coronary artery bypass surgery: high incidence without perioperative myocardial infarction. Am Heart J 1982;103:85–91.
4. Bateman TM, Weiss MH, Czer LSC, et al. Fascicular conduction disturbances and ischemic heart disease: adverse prognosis despite coronary revascularization. J Am Coll Cardiol 1985;5:632–9.
5. Wexelman W, Lichstein E, Cunningham JN, Hollander G, Greengart A, Shani J. Etiology and clinical significance of new fascicular conduction defects following coronary bypass surgery. Am Heart J 1986;111:923–7.
6. Baerman JM, Kirsh MM, de Buitleir M, et al. Natural history and determinants of conduction defects following coronary artery bypass surgery. Ann Thorac Surg 1987;44:150–3.
7. Caspi Y, Safadi T, Ammar R, Elamy A, Fishman NH, Merin G. The significance of bundle branch block in the immediate postoperative electrocardiograms of patients undergoing coronary artery bypass. J Thorac Cardiovasc Surg 1987;93:442–6.